VII.
System Operation

During the more than four decades of institutional change associated with the Pick-Sloan Missouri basin plan, the affected states and Indian tribes were frustrated by their lack of control over water-management issues. Section 1 of the 1944 Flood Control Act recognized rights and interests of states in water resources development, and required federal agencies to consult and coordinate with the states. In certain instances involving proposed developments, such as the Osage basin projects in Missouri, that legal requirement satisfied state demands and resulted in altered plans.[1] However, Indian rights regarding water management were not clarified nor considered in operational plans.[2] In other sections of the 1944 act, federal agency power dominated. Sections 6, 7, and 8 authorized the Corps of Engineers through the Secretary of the Army to prescribe operating regulations for use of storage allocated for flood control or navigation, to dispose of stored water not needed for authorized purposes, and to provide water for irrigation.[3] Despite this clear authority, operating principles for mainstem projects became controversial.

The Corps of Engineers and the Bureau of Reclamation discussed principles of operation for multiple purpose reservoirs early in the basin development program. Representatives of the two agencies met in Omaha in May 1949 and in Denver the following November to reach an agreement. It dictated that whichever agency constructed and maintained the dam would be primarily responsible for its functional operation for purposes other than irrigation and flood control. The agreement also stated that separate offices for scheduling storage and releases at reservoirs having both flood control and irrigation purposes would not be necessary. Methods of forecasting and agreements on details of operation were to be worked out for each reservoir.[4]

William Glenn Sloan of the Bureau of Reclamation reported on the agencies' preliminary discussions to the Missouri Basin Inter-Agency Committee at its meeting in September 1949.[5] Sloan, who was then chairman of MBIAC, suggested central operations control for all federal reservoirs in the basin. He raised some fundamental questions. The time had come for open and objective discussion.

Brigadier General Samuel D. Sturgis, Jr., MRD Division Engineer,

recorded in his notes that Sloan's suggestion could be "lethal in effect." He elaborated that MRD had been working out dam and reservoir control "by cooperation with the Bureau on the technical level."[6] Sturgis intended to oppose Sloan's initiative.

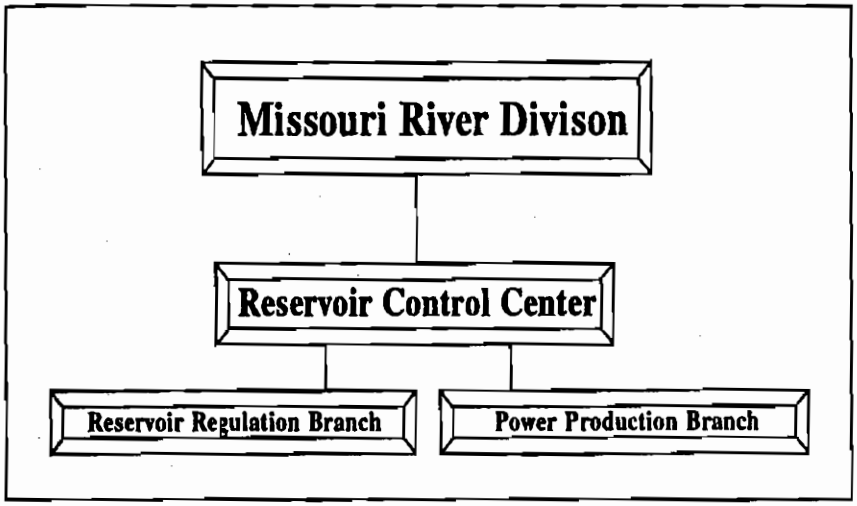
The Corps was pressed by some state officials who supported Sloan's proposal. At a 30 November 1949 meeting of the Missouri River States Committee, Nebraska State Senator C.P. Peterson proffered that when the operational stage was reached, "some morning a decision" would have to be made whether to release water in support of navigation or hold it to sustain irrigation.[7] He said that would not be the time for an interagency debate. Governors William Bonner of Montana and Forrest Smith of Missouri stressed the importance of involving the states. Nebraska Governor Val Peterson, in his capacity as chairman of the MRSC, requested that the Council of State Governments study operational phases of the Missouri River development program and submit recommendations.[8]

Corps leaders acted without waiting for the council's report. General Sturgis got on the agenda of the January 1950 MBIAC meeting to pursue the Corps' objectives to control reservoir operations. He explained some of the factors affecting plans for the operational phase and emphasized the need to collaborate with the states. Sturgis said problems could be solved "only through mutual and cooperative efforts, through give and take, through efficient operations, not by new organization charts."[9]

The Corps clearly intended to fulfill its legally mandated assignment and take the lead to control operations of the main-stem dams and reservoirs. It was amenable, however, to sharing water management on tributary streams west of the main stem. Meetings with the Bureau of Reclamation between 5 June 1951 and 15 February 1952 affirmed the Corps' position.[10]

The Corps and Reclamation Work Group on Coordination of Interests considered in detail the problems and basic requirements of operation of the main-stem dams and reservoirs for each individual function. It evaluated the system's capacities under historic extremes of drought and high-water runoff conditions. The work group examined items of mutual interest or potential conflict between the various functions to be served in multiple-purpose operations.

The work group reported in 1952. It concluded that on main-stem and some tributary projects, navigation and flood control operations related directly to irrigation and hydropower. Other multiple-purpose features that were to be served by the stored water had "practically no operating interrelation."[11]



The Corps would ascertain when water was to be released from the main-stem system to meet requirements. The work group affirmed that MRD's Reservoir Control Center (RCC) would coordinate the acquisition and analysis of all hydrologic data required by the Corps in the operation of the dams and reservoirs. The RCC also would study power production potentialities, prepare storage balance relationships among reservoirs, and make other studies for the purpose of developing multiple-purpose operations favorable for power.

MRD wanted some institutional arrangement whereby technical representatives of other federal agencies and the states could express their viewpoints on operations of the multiple-purpose projects. The coordination work group reported that the Corps would develop "channels for the expression of operational objectives by other agencies." MRD established a coordinating committee to ensure that all concerns were represented adequately in annual operating plans and then acted on if appropriate.[12]

Coordination as practiced by the Corps of Engineers went beyond the requirements of section I (a) of the 1944 Flood Control Act. The act provided that before any of the Chief of Engineers' plans, proposals, or reports for improvement works were submitted to Congress, the investigations were to be coordinated with each affected state and the reports submitted to such states for comment and recommendation. The Corps extended that policy concept to include participation in the formulation of operating plans for completed projects. Accordingly, the desires and views of the states were considered and complied with insofar as possible

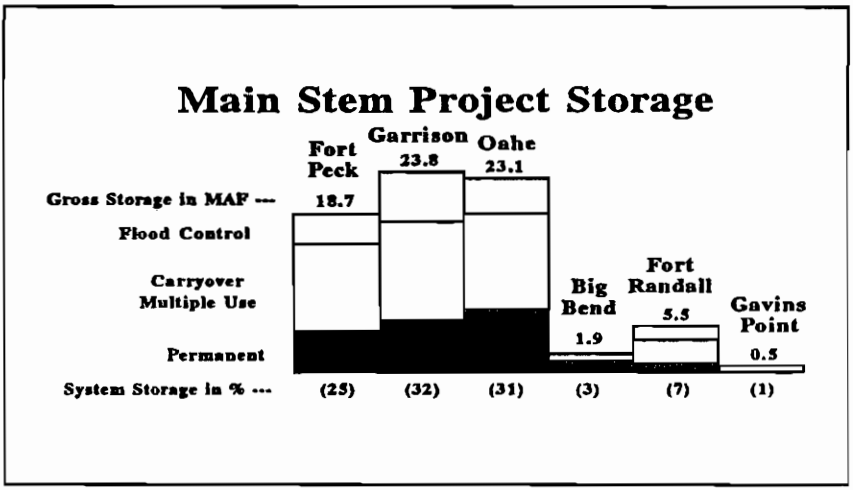
and consistent with project authorizations. This coordination was to be accomplished through the Coordinating Committee on Missouri River Main Stem Reservoir Operations.[13]

In December 1953, Sturgis's successor Brigadier General William E. Potter, explained MRD's functional operations control concept.[14] He cited a team game as an analogy. Like members of a team, he said, each of the six main-stem dams and reservoirs had certain important functions to perform: "But to provide a winning combination which will give the people victory over floods and maximum benefits from use of controlled water, their functions must be fully coordinated."

Brig. Gen. William E. Potter.

Potter explained how the operational team evaluated the work to be performed. With the six main-stem reservoirs filled, the team had under its control a total main-stem storage capacity of 76.8 million acre feet (MAF), the largest storage for any system of reservoirs in the nation. (As of spring 1992, storage capacity of the main-stem system had been reduced from 76.8 to 73.7 MAF, or a 3.0 percent storage loss in 39 years.)[15]

The Missouri River Pick-Sloan system is unique because the ratio of



1991 CALENDAR YEAR RUNOFF FOR SELECTED REACHES

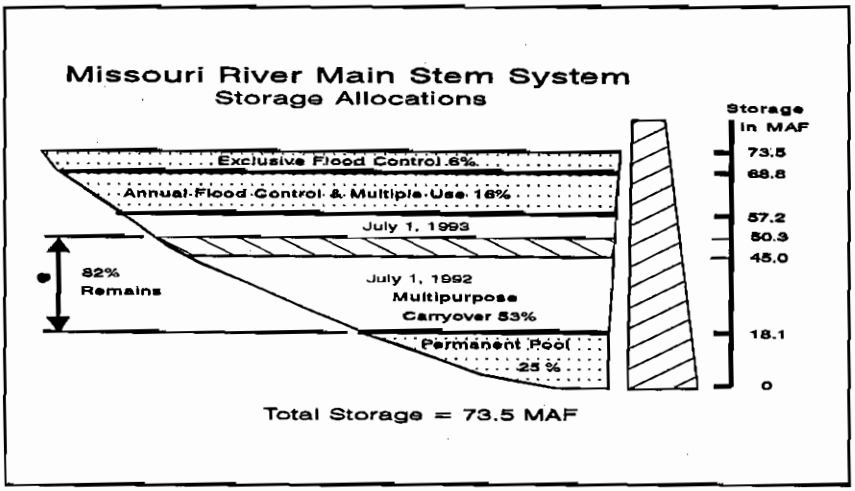
Reach	Runoff		
	1898-1987 Average Volume	Calendar Year 1991 Runoff-Volume	Percent of Average Runoff
		(1,000 Acre-Feet)	
Above Ft. Peck	7,470	7,061	95
Ft. Peck to Garrison	11,080	9,677	87
Garrison to Oahe	2,350	1,833	78
Oahe to Ft. Randall	910	709	78
Ft. Randall to Gavins Point	1,510	2,149	142
Gavins Point to Sioux City	1,680	901	54
TOTAL ABOVE SIOUX CITY	25,000	22,330	89
Sioux City to Nebr. City	7,530 [1/]	5,800 [1/]	77
Nebr. City to Kansas City	11,930 [1/]	4,990 [1/]	42
Kansas City to Hermann	23,160 [1/]	15,160 [1/]	66
TOTAL BELOW SIOUX CITY	42,620	25,950	61

[1/] Except for reaches from Sioux City to Hermann. Averages are taken from USGS Water-Data Reports for the period 1967-1987, adjusted to 1949 depletions.

storage to runoff is high. Total annual runoff upstream from Sioux City, Iowa, for the years of record 1898 to 1991 averaged nearly 25 MAF, or only about a third of the total storage capacity. All of that storage was not, of course, available for use. The system of reservoirs must be viewed as one in which water is stored in four separate storage zones.

A top zone consisting of about 4.6 MAF or 6 percent of capacity is reserved for the control of the most severe floods. This exclusive zone is evacuated as soon as possible, downstream flooding conditions being the only constraint in release scheduling. Flood control operation is not a use of water but absolutely requires that adequate storage space be available whenever needed to prevent downstream flooding. It is the only function the reservoirs serve that requires evacuated storage.

At the bottom of the reservoir system is a "permanent zone." This zone, which consists of 18.2 MAF or 25 percent of the total storage



capacity, is provided to assure minimum head required for power generation and sediment retention, and to allow for continued recreation and fish and wildlife purposes (although at greatly reduced benefits). Permanent pools in each of the reservoirs remain filled with an amount of water that is unavailable for flow regulation.

The largest storage area in the system is a multi-purpose carry-over zone. It contains 39 MAF or 53 percent of the total storage of the six reservoirs. The operations team's goal was to save the water in the multipurpose zone whenever possible so that it could continue to support all project functions during extended drought periods such as the 12-year drought of the 1930s. The operating rules contained in the Master Water Control Manual are defined so that as storage declines in this zone, less water is released.

During years of adequate water supply, the Corps prefers to operate in the next higher zone, the annual flood control and multiple-use zone. The Corps uses this zone to equitably support all authorized functions. The task is difficult at times because the zone consists of only about 11.7 MAF, or 16 percent of system storage capacity. Fortunately, water has never been allocated in the system to benefit specific project purposes. All purposes share the stored water, which enhances the operational team's flexibility in meeting demands.

Potter explained the operational concept in scheduling the retention or release of this water. The first consideration was flow requirements for water supply and public health as determined by the states and the U.S. Public Health Service. This was in accord with a unanimously adopted MBIAC resolution of 23 March 1950, which stated that operational

policy should recognize the need to protect the interests of public health and welfare east of the 98th meridian in the lower basin, just as section I (b) of the 1944 Flood Control Act protected the land area of the basin west of the 98th meridian.[16]

Potter stated that the next consideration in scheduling the release or retention of water from the main-stem reservoirs would be to satisfy requirements for irrigation.[17] These decisions regarding water needed for irrigation at federally sponsored projects were to be made through data pooling by the affected states, MRD, and the Bureau of Reclamation. All authorized irrigation and other upstream beneficial consumptive uses were to be allowed for.

MISSOURI RIVER NAVIGATION FLOW TARGETS

Target Location	Full Service	1989 Target	1990-92 Target (Minimum Service)
Sioux City	31,000 cfs	28,000 cfs	25,000 cfs
Omaha	31,000 cfs	28,000 cfs	25,000 cfs
Nebraska City	37,000 cfs	34,000 cfs	31,000 cfs
Kansas City	41,000 cfs	38,000 cfs	35,000 cfs

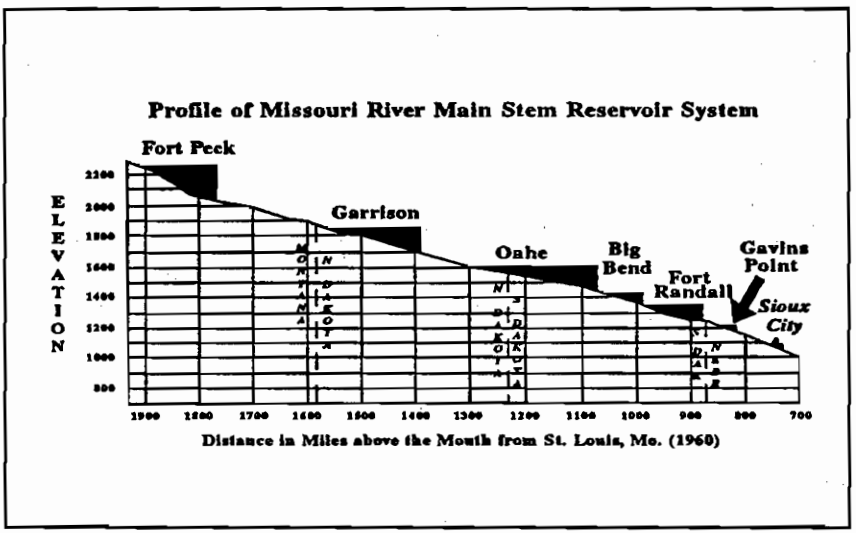
The remaining water supply was to be scheduled so that reservoir releases through the lower-most dam in the mainstem system supplied the seasonal requirements for navigation. Experience, and data collected in 1953, indicated that flows of 25,000 cubic feet per second at Sioux City, Iowa, and 35,000 cfs at Kansas City, Missouri, would permit a 9-foot-deep by 300-foot-wide navigation channel with little or no dredging. Later, the flow targets were increased to 31,000 and 41,000 cfs, respectively. The navigation channel extends 732 miles from Sioux City to the Missouri's confluence with the Mississippi River just above St. Louis.

The Missouri River is free flowing and has no locks and dams. The last flow-control point for the main-stem dams is at Gavins Point Dam, located 80 miles upstream from Sioux City. Flow support for navigation generally is limited to eight months, or almost the entire ice-free season. Season lengths are extended by ten days when excess water is available, but ice conditions do not permit longer extensions. Navigation tows generally work in the lower river prior to the scheduled opening dates if tributary flows are adequate to maintain the needed stages.

Flows of at least 9,000 cfs at Sioux City are required during the ice-free season (without commercial navigation) to permit cities and utilities to take water from the river. Actually, nonnavigation releases have varied from as much as 23,000 cfs, to evacuate excess water, down to 8,500 cfs during drought periods. During extreme rainstorms, releases have been reduced in the navigation season to only 6,000 cfs in order to minimize downstream flooding.

In his 1953 statement, Potter explained that all six main-stem dams and reservoirs were to be regulated internally and adjustments made in the outflow from the system to provide for the maximum generation of hydropower consistent with uses described above. Power plants at the dams on the Missouri River may use nearly all of the reservoir releases made for water supply and navigation. However, Potter envisioned that some special patterning of reservoir releases would be necessary to realize maximum power potentials. For example, when navigation flows are cut, power generation drops dramatically because the quantity of water being released from the four most downstream reservoirs is reduced. At the same time, releases from the upstream dams can be increased to generate more energy from previously stored water. In addition, Big Bend and Oahe releases are reduced in the fall period in order to reduce the storage in Lake Francis Case. Those project releases are increased in winter months to refill the evacuated storage in Lake Francis Case, thus further increasing winter energy production.

Internal system regulation is facilitated by the way the system receives water. Mountain snowmelt runoff flows into the two uppermost



reservoirs during May, June, and July. Characteristically, Fort Peck gets 32 percent of the total inflow into the system and it generates 11 percent of the hydropower the six dams produce. Garrison gets an additional 8 percent of the total inflow and generates 26 percent of the hydropower through the release of its incremental inflow plus the passing of Fort Peck's release. As the summer power load increases, water is released from these two upper-most reservoirs to maintain or raise the level of Oahe.

Natural runoff into Oahe is limited by plains snowmelt, which is generally low compared to mountain snowpack runoff and occurs during March and April. That inflow is supplemented by modest inflows from rainfall runoff. Oahe averages only 10 percent of total runoff into the main-stem system, but generates 28 percent of the power due to passing its local inflow plus the releases from upstream projects. Flows for navigation in the spring are supported primarily by Oahe; Fort Peck and Garrison releases are slowed. Those project releases are again slowed in the fall period, resulting in reduced levels at Oahe. The evacuated storage is refilled by the first of March to the base of the flood control pool, if possible.

These three upper-most reservoirs are large by all standards. In fact, Garrison, Oahe, and Fort Peck are the third, fourth, and fifth largest storage reservoirs in the United States. Only the Bureau of Reclamation's Glen Canyon and Hoover dams, forming Lake Powell and Lake Mead, store more water than does Garrison. The three reservoirs' total capacity constitutes 88 percent of the system's storage volume. Average annual releases from Fort Peck, Garrison, and Oahe are approximately 10,800, 24,100, and 26,600 cfs, respectively. Functioning as an integrated unit, these upper-most main-stem Corps projects provide operating flexibility and opportunities to maximize multi-purpose benefits.

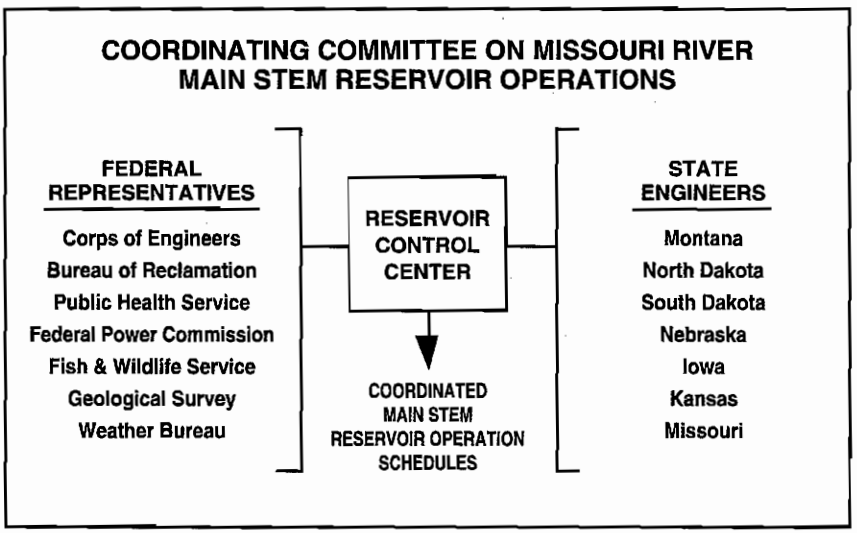
The three lower-most reservoirs are smaller. Big Bend, located downstream from Oahe, does not receive enough inflow to register a percent in the system total, but it does generate 10 percent of the system hydropower production due to the passing of upstream project releases. Fort Randall's incremental inflow is typically 4 percent of the total and it generates 18 percent of the hydropower. The lower-most dam and reservoir, Gavins Point, generally has 6 percent of the inflow and, due to a relatively low head, generates 7 percent of the system's normal annual power production of 10 billion kilowatt-hours.

Potter noted in his 1953 statement that operational objectives other than hydropower needed to be incorporated to the maximum extent practicable in operating policy. For example, he said that the interests of

fish and wildlife and recreation would receive "appropriate and important consideration." Federal and state fish and wildlife agencies would furnish data that the operating team might use in timing and establishing reservoir levels. Corps main-stem system operations would reflect these considerations insofar as practicable without serious interference with the primary authorized functions, Potter said.

The Missouri River Main Stem Reservoir System Reservoir Regulation Manual, initially prepared in 1960, outlined the operating philosophy and described considerations for planning project operations. The Annual Operating Plan (AOP) provides the basis for the Corps of Engineers' placing the concepts of functional relationships and priorities into actual operations. Implementation procedures involve three main elements: (1) estimates of water supply to the reservoirs; (2) determinations of requirements for water supply to the reservoirs; and (3) monthly water schedules for storing and releasing water for optimum coordination of available supply with requirements. MRD's RCC prepares these schedules a year ahead of actual operations to provide adequate time for advance coordination among affected federal and state agencies and other public- and private-sector interests.

While the RCC has primary responsibility for this activity, many disciplines provide support. RCC professionals begin drafting the AOP soon after the first of August. They consolidate information obtained from many sources on various water requirements and develop preliminary reservoir operation water schedules that serve as a basis for coordination with federal, nonfederal, and private interests.



Beginning in 1953, when the Fort Randall project began operating and was combined with the Fort Peck project, federal agency representatives and state engineers assisted the RCC in assembling the information needed on the various operating requirements.[18] This coordinating committee, established at the request of the MRD Division Engineer and chaired by the RCC chief, met in general conference twice a year to review, modify, and agree on the annual operating plan objectives. The committee was advisory only. Subsequently, the RCC executed the details of the AOP through daily interchanges with other interested parties.

These coordination arrangements and procedures were acceptable to most basin interests. However, reservoir operations were controversial as early as 1958, nearly a decade before the six main-stem reservoirs were filled to normal operating levels. Although procedural aspects were virtually unopposed, some interests being served by the multiple purposes of the main-stem system wanted changes in operating priorities.

Coordinating Committee.

On 29 April 1958, the Coordinating Committee on Missouri River Main Stem Reservoir Operations held a special public meeting to obtain the views of affected interests. About 110 persons attended, with 32 representatives of organizations presenting their views for the committee's consideration. Electric power cooperative spokespersons urged that power be given priority over navigation and that navigation releases be curtailed drastically or suspended, at least until the main-stem reservoir storage was filled to normal operating levels. They wanted the system operated for maximum production of year-round power sufficient to supply contract customers.[19]

Power-industry spokespersons stated that the O'Mahoney-Millikin amendment to the Flood Control Act of 1944 established a priority for power over navigation. A few witnesses suggested that power should be incidental to other functions. One witness also questioned the accuracy of the 1951 Report on Adequacy of Flows in the Missouri River and called for an immediate restudy. The Adequacy of Flows report, an inter-agency and state review and analysis of water supply published in 1951, concluded that the Missouri River's regulated water supply was adequate to provide for the multiple-purpose uses, taking into account that severe drought conditions would result in tolerable irrigation shortages on some tributaries and tolerable shortened navigation seasons.[20] The Coordinating Committee members representing the states and participating federal agencies concluded that such shortages should be tolerated to afford maximum use of the basin's water and land resources.[21]

The only substantial change in basic information and assumptions since the 1951 report was a considerably reduced estimate of future depletions of water supply for irrigation in the Missouri River above Sioux City. This information, provided by the Bureau of Reclamation, did not alter the conclusion that the Missouri River's water supply was adequate. Notwithstanding some minor changes in the original basic data assumptions, the Coordinating Committee concluded that a detailed restudy was not needed.

The O'Mahoney-Millikin amendment to the 1944 Flood Control Act and the Rivers and Harbors Act of 1945 did not specifically address the relative priority of hydroelectric power and navigation. This question was the focus of a special joint hearing in 1957 before the Committee on Interior and Insular Affairs and the Committee on Public Works of the U.S. Senate. The Chief of Engineers, in a letter to the chairman of the hearing, said that in his view the O'Mahoney-Millikin amendment did not establish any priority for power over navigation. He cited Senate Document 247 as stating that the Corps and Bureau of Reclamation recognized "the importance of the fullest development of the potential hydroelectric power in the basin consistent with other beneficial uses of water."[22]

The Coordinating Committee agreed with the Chief's conclusion. The committee reported that "any blanket proposal for maximum service to any function by elimination or inequitable reduction in service to any other primary function" was incompatible with the authorizing legislation.[23] Actually, operations for navigation and power release are quite compatible. A Corps official stated that if navigation was not supported, the annual water supply could be adjusted between the reservoirs to

generate more power during the summer and winter when its value would be greater. Likewise, not supporting power would require some seasonal operationing adjustments. Reservoir operations would undergo few changes if either navigation or hydropower production were eliminated.[24]

The Coordinating Committee responded to witnesses who requested that reservoirs be filled and stabilized for recreation and other local uses. It concluded that the primary authorizations were for flood control, irrigation, navigation, and hydropower and that reservoir water levels must fluctuate in order for the projects to function effectively for these purposes. The committee stated that even in normal years water levels in the Fort Peck, Garrison and Fort Randall reservoirs might fluctuate as much as 10 to 15 feet in a few months, therefore making it "impractical to consistently maintain the reservoirs at levels that will completely satisfy many recreationists."[25]

In addressing and clarifying these issues, the Coordinating Committee performed an important public service. Correspondingly, it served the basin in facilitating establishment of operating schedules in accord with the original basic concept of multiple-purpose development and use of surface-water resources. Unfortunately, the Coordinating Committee came within the purview of the Federal Advisory Committee Act (P.L. 92-463). The committee was dissolved in late 1981 rather than complying with the requirements needed in order to continue.[26]

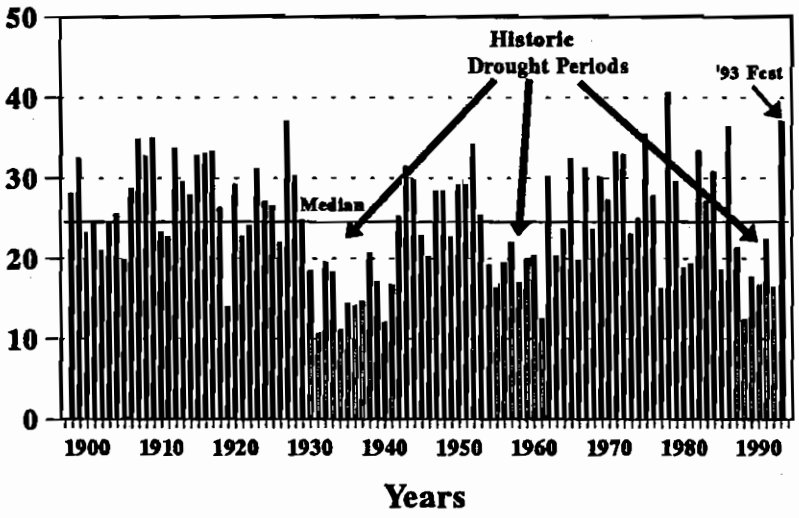
In January 1982, MRD announced its alternative policy approach to the demise of the Coordinating Committee. To perpetuate the committee's functions as much as possible without violating the intent of the Advisory Committee act, MRD would hold semiannual public meetings to discuss basin water-management concerns.[27] At the spring meeting, operational objectives would be outlined for further consideration in drafting the next Annual Operating Plan. Then at the fall meeting, the tentative operating schedules prepared in the interim by the RCC were to be reviewed and revised for use as the basis for actual operations and a draft plan presented for the upcoming year.

Operational considerations presented at the semiannual meetings did not generate much discussion in the first years. However, the variable climate in the vast basin put stress on the system. Floods followed by droughts greatly increased the involvement by those relying on the Missouri River and its reservoirs for business and pleasure.

Even under the best of runoff conditions and reservoir elevations, multi-purpose functions served by the main-stem dams and reservoirs are sometimes in competition. For example, regulation for flood control may cause users immediately downstream from a project to have lower than

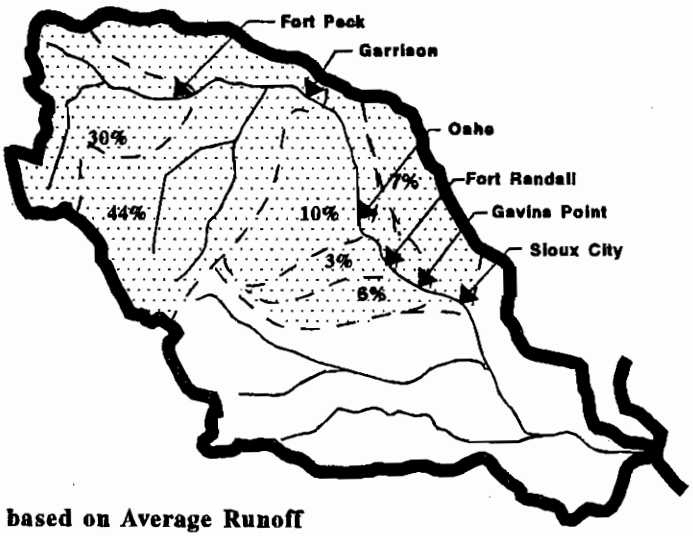
Annual Runoff at Sioux City, Iowa

Adjusted to 1949 Level of Depletions



Missouri Basin Runoff

by River Reach



based on Average Runoff

normal flows that affect power generation, recreation, and fish and wildlife. Fluctuating reservoir levels due to droughts and floods affect irrigation and recreation interests, who prefer a relatively constant pool.

These and other issues exist for the RCC throughout the river reaches of the Missouri. Releases must be regulated for water uses on open river in reaches other than below Gavins Point. There are approximately 200 miles of open river below Fort Peck, 100 miles below Garrison, and 50 miles below Fort Randall. And during the 1980s, a growing array of organized interests began formally expressing their concerns about the effects of reservoir regulation.

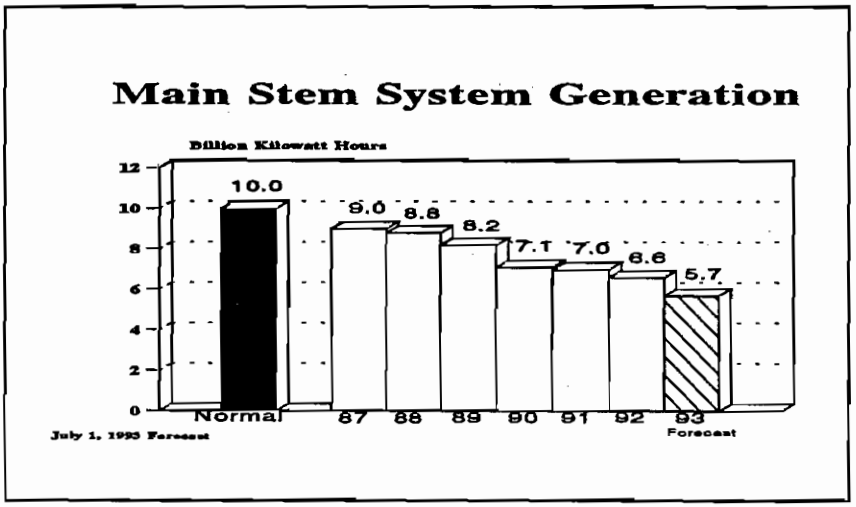
Impacts on dam and reservoir operations caused by varied climatic conditions across the Missouri River basin served as a catalyst for controversy. Runoff records dating from 1898 illustrate a part of the problem for reservoir regulation. While 1977 was dry, runoff was not as low as the record of only 10.7 MAF in 1931. The year 1978 had a record runoff of 40.7 MAF. Both 1981 and 1982 were drought years, but 1983 had the third largest runoff on record.

These runoff extremes may be exacerbated by simultaneous conditions within the basin, such as drought in one subarea and high rainfall in another. For example, during 1986, the five-month runoff in the reach from Garrison to Gavins Point was the maximum for the period of record and record flooding occurred in the lower Missouri basin. At the same time, the upper basin was extremely mild and dry.[28]

The main-stem system inflows for March 1987 were 165 percent of normal due to a heavy and accelerated plains snowmelt. System regulation provided the largest flow reduction since construction of the dams and prevented massive damage from Bismarck, North Dakota, to St. Louis, Missouri. Conditions in the upper reaches of the system contrasted sharply with those in the lower reaches. Because mountain snowpack and summer rainfall were well below normal for the winter of 1986-1987, runoff for the year was below normal.

These conditions and voices of dissent were a portent of the future. Following the record high-water stages experienced in the lower basin in 1986, the Riparian Association contended that the flood control reserve was inadequate. The Corps of Engineers was willing to evaluate the effects of increasing flood control storage in the main-stem reservoirs, but noted that more space given to flood control would result in lower power heads and less hydropower generation.[29]

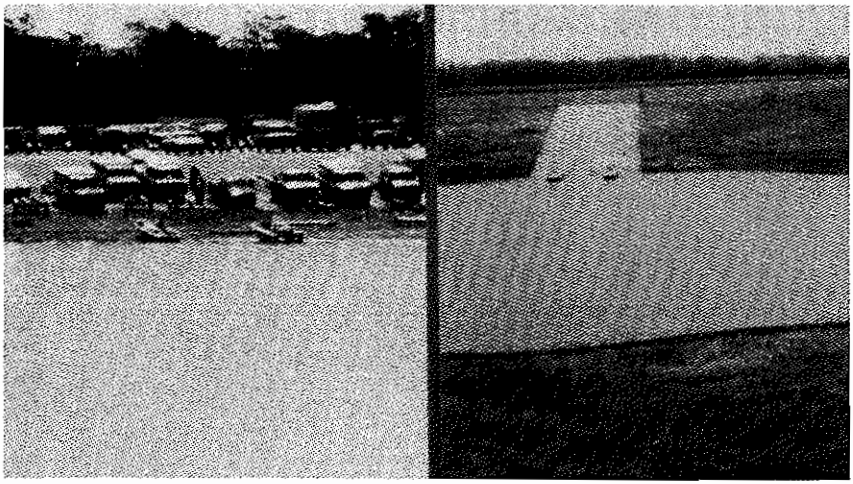
The Missouri Basin Systems Group (MBSG), representing some 200 rural and small municipal electric utilities, would oppose the Riparian Association's request. Members of the MBSG purchased 71 percent of



the hydropower produced by the main-stem system in 1986 and committed under firm power contracts. A change in system operations would threaten those firm commitments, disrupt funding arrangements for local governments and institutions, and alter the Pick-Sloan project plan budgets. Annual power generation averages approximately 10 billion kilowatt-hours with revenues ranging from $75 million to $100 million a year, depending on water and marketing conditions.

The reservoir control team had requests from state and federal fisheries interests that were also in conflict with the Riparian Association. Since 1968, Nebraska, South Dakota, North Dakota, and Montana fisheries personnel had coordinated their fisheries management recommendations to the RCC through the Upper Missouri River Chapter of the American Fisheries Society.[30] The Corps urged (1) the formation of a Natural Resources Committee to facilitate handling various states' requests and (2) expansion of the committee's scope to include wildlife enhancement (this involvement to be coordinated through the U.S. Fish and Wildlife Service).

The RCC sometimes had difficulty implementing the recommendations of the fisheries interests. For example, Oahe received record inflows during the spring of 1986 and the pool elevation soared to a record high (which was to be broken in 1987). Fisheries interests wanted the pool held at least ten feet lower. They preferred that the Corps draw a reservoir down and hold it down for one or more years to establish vegetation along the shoreline. Then, when flooded in succeeding years, the vegetation would provide spawning habitat and nutrients. The problem is the



Lake Oahe — June 1987 at 1613' and April 1991 at 1588'.

uncontrolled rise from inflows and balancing the system through the natural cycle.

Sometimes the RCC simply has too little water to meet competing demands. In 1987, annual water supply was lower than expected 90 percent of the time, based on the entire period of record since 1898. The fall of 1987 was extremely dry and warm, and winter mountain and plains snowpack was far below normal. The subsequent summer was one of the hottest and driest on record. In the fall of 1988, reservoir storage was the lowest in the 22-year period since the system first reached normal operating level and was entering the second cycle of a 2-year drought.

The drought of 1981-1982 was broken with excellent inflows. Nature was not as kind in the case of a later drought. Colonel George LaBlonde of the Missouri River Division opened the 1988 fall public meeting by stating that "This year we are dealing with a devastating drought."[31]

The basin main-stem system would experience an extensive dry period. (Other such periods were the 12-year drought of the 1930s and an 8-year drought during the 1950s.) By late 1991, the RCC reported that runoff for the Missouri River above Sioux City had been "significantly below normal for each of the past five years."[32]

The drought's effects were numerous and varied, and basin residents would probably feel them for years to come. The Upper Missouri Basin Governors' Association expressed concern in August 1989 that the recreation industry, domestic water supplies, and riverine irrigation were threatened. Fisheries resources in Montana, North Dakota, and South Dakota were threatened and the governors were concerned about recov-

MISSOURI RIVER POWERPLANTS

COAL FIRED	MW
Neal North	935
Neal South	600
OPPD — No. Omaha	600
Council Bluffs Energy Center	845
OPPD — Neb. City	550
St. Joseph — Lake Road	100
KCPL — Iatan	700
Nearman Creek Power	256
KCP&L — Grand Ave.	peaking
KCP&L Hawthorne	909
Indep. Power — Mo. City	peaking
Sibley Power	514
Quindaro Power	229
Chamois Power	71
Labadie Power	2400

NUCLEAR	
OPPD — Ft. Calhoun Nuclear	500
NPPD — Cooper Nuclear	800
Callaway Nuclear	1240

ery. Resort operators and the public had experienced loss of boating access and protected marinas. Hydropower production was reduced substantially and the governors feared that power generation would not return to normal for "several years."[33]

Lower basin users of the Missouri River were also hurt by the drought. Below Gavins Point, 15 coal-fired and 3 nuclear power plants, generating approximately 11,150 megawatts of electric energy, rely on the Missouri River for cooling water. A users group of 15 member utilities relies on the lower river for public water supply to some four million people. These interests expressed concern that the Corps policy of reducing releases from the main-stem system in order to conserve water might interrupt their delivery of vital services.[34]

The Corps adopted a policy of releases from Gavins Point of 10,500 cfs and below during winter months. Some water supply intakes, which are fixed structures, were at elevations above river stages. When icing

Water Supply Intake.

conditions in the river blocked flow, the facilities were shut down. For example, St. Joseph, Missouri, was without water for three days in February of 1989. Summertime flows during 1988 and 1989 were insufficient to bring temperatures within a comfortably safe operating range, according to industry spokespersons.

The public water supply and electric energy representatives stressed to the Corps the necessity of maintaining releases that would provide river stages adequate for their water withdrawal facilities. For the health and safety of millions of people, their industries must supply uninterrupted services that depend on Missouri River water. Through industry spokespersons and elected representatives, they declared that maintenance of minimum flows for public water supply must be the highest priority issue in the main stem. The Public Water Supplies Association petitioned the Corps for minimum releases of 15,000 cfs at Gavins Point.[35]

Missouri River water supply users were willing to take measures to enhance their ability to draw water from the river during low flows. However, modifying the fixed structures to operate with lower river stages than those contemplated in the original design required large capital expenditures and complex, time-consuming engineering and construction. Until they could modify their intakes, the water users wanted the Corps to provide relief through additional releases.

The basic problem for these users was that river channelization has caused the stream bed to degrade. Prior to construction of the main-stem dams and stabilization of the downstream channel, the Missouri River

carried over 150 million tons of sediment annually, much of which is now captured by reservoirs behind the main-stem dams. Without the heavy sediment load, the water has scoured out and lowered the river bed.[36]

A flow of 12,500 cfs occurs at a lower surface elevation than that prior to the Pick-Sloan project period, when many water intakes were built. Intake designs were based on historic river conditions with pump requirements and locations determined by known high- and low-water stages. Degradation has affected the original design specifications. With low flows in the downstream reaches during 1988 and 1989, many suction lifts were in excess of the maximum design of the facilities' pumps.

The Corps had considerable difficulty conserving water during the drought period. The RCC had set a release rate that was commensurate with the runoff rate, about 75 percent of normal. As of 1 October 1991, after four years of drought, more than 38 percent of the water in the carryover multi-purpose zone had been used.[37] (During drought conditions, releases are reduced in proportion to the level of water storage in the carryover multiple-use zone.) Since the system filled in 1967, the average annual release from Gavins Point has been 29,400 cfs. In 1989, the average annual release was 23,000 cfs, and in 1990 and 1991 between 20,000 and 21,000 cfs.

The water resulting from the releases was not sufficient for the water users along the lower river who withdrew water through intakes or who were barge and marina operators. The average tow on the Missouri River consists of six barges at full-service flows, which are represented by 31,000 cfs at Sioux City and 41,000 at Kansas City. The Corps had provided releases of 3,000 cfs below full service during 1989 and 6,000 cfs in 1990. As a result, the seasons opened one week late and closed four weeks early.

These water conservation measures had a number of negative impacts on the navigation industry. Tow operators had to reduce their loads to a maximum draft of 7.5 feet, representing at least 16 percent less carrying capacity than in a normal year. Risks of groundings increased, and trip times had to be lengthened. The American Commercial Barge Lines, which had maintained five or six vessels on the Missouri River, reduced operations about 60 percent by the fall of 1990.[38] Commercial tonnage dropped from a peak of 3.3 million tons in 1977 to a 1990 estimate of only 1.4 million tons.[39]

Tow operators had trouble navigating even in the opening weeks of the 1990 season. Commercial marinas had to shut down or dredge. In 1988 and 1989, the Corps dredged the lower river reaches in order to

MISSOURI RIVER COMMERCIAL NAVIGATION TONNAGE AND SEASON LENGTH

Year	Scheduled Length of Season (Months)	Commercial Shipments (tons) (1)	Total Shipments (Tons) (2)	Traffic (1000 Ton-Miles) (1)
1954	7-3/4	297,149		
1955	7	435,455		186,291
1956	7	319,076		132,614
1957	6	273,895		99,710
1958	7	596,116		242,986
1959	7	842,812		380,475
1960	7-3/4	1,440,985	6,948,875	686,412
1961	6-1/2	1,565,736	6,187,381	718,597
1962	8	2,206,680	8,468,705	989,414
1963	8	2,316,066	7,978,002	1,002,745
1964	8	2,549,795	7,633,415	1,126,958
1965	8	2,270,789	7,725,898	1,013,944
1966	8	2,562,867	7,948,179	1,193,112
1967 (3)	8	2,562,657	6,659,219	1,179,235
1968	8 (4)	2,254,489	6,724,562	1,047,935
1969	8 (4)	2,123,152	7,001,107	1,053,856
1970	8 (5)	2,462,935	7,519,251	1,190,232
1971	8 (4)	2,791,929	7,483,708	1,329,899
1972	8 (4)	2,665,579	7,182,841	1,280,385
1973	8	1,817,471	6,370,838	844,406
1974	8	2,576,018	7,673,084	1,227,525
1975	8 (4)	2,317,321	6,208,426	1,105,811
1976	8 (4)	3,111,376	6,552,949	1,535,912
1977	8	3,335,780	6,734,850	1,596,284
1978	8 (4)	3,202,822	7,929,184	1,528,614
1979	8 (4)	3,145,902	7,684,738	1,518,549
1980	8	2,909,279	5,914,775	1,335,309
1981	7-1/4 (6)	2,466,619	5,251,952	1,130,787
1982	8 (4)	2,513,166	4,880,527	1,131,249
1983	8 (4)	2,925,384	6,301,465	1,300,000
1984	8 (4)	2,878,720	6,386,205	1,338,939
1985	8 (4)	2,606,461	6,471,418	1,201,854
1986	8 (7)	2,343,899	6,990,778	1,044,299
1987	8	2,405,212	6,735,968	1,057,526
1988	7-1/2	2,156,387	6,680,878	949,356
1989	6-3/4	1,906,508	5,352,282	796,799
1990	6-3/4	1,329,000	5,841,000	
1991	6-3/4	1,500,000 (8)		
1992	6-3/4	1,200,000 (8)		

(1) Tonnage figures from Waterborne Commerce of the United States except for the years 1954-1959 which were provided by the Kansas City District Corps of Engineers.
(2) Includes commercial commodities; sand, gravel and crushed rock; and waterway improvement materials. Total shipment figures provided by Waterborne Commerce were not available prior to 1960.
(3) Main stem reservoir system reached normal operating storage level in 1967.
(4) 10-day extension of season provided.
(5) 10-day extension and 10-day early opening provided.
(6) Full service flows for shortened season in preference to reduced service.
(7) 10-day extension provided for 1985 season in trade for 10-day delayed support of 1986 season.
(8) Preliminary numbers not final — will be changed.

maintain the minimum navigation channel. And, compounding the problems with commercial navigation, the Corps missed target flows by as much as 6,000 cfs. One discouraged barge industry spokesperson said that "at 25,000 cfs there is no release for navigation" anyway.[40]

At the same meeting at which navigation spokespersons and lower basin water users requested the Corps to release more water from the reservoir system, upper basin interests represented the opposite position. A South Dakota official said the state had "repeatedly stated the need" to maintain stable levels in the main-stem reservoirs "for fisheries, recreation, water supply intakes, and other purposes." Upper basin state representatives wanted the Corps to further curtail the length of the navigation season and to adopt operating plans that "more evenly distributed" the effects of drought between the upper and lower basin states.[41]

In developing the operating plans for 1991 and 1992, during the fifth year of drought, the Corps broadened its integrative process for drafting the AOP. Previously, the draft AOP provided the first opportunity for review of Corps recommendations. The Missouri Basin States Association appointed a technical committee to work with the Corps staff, analyze an array of factors, consider various operations proposals, and develop recommendations for the draft AOP.[42]

During their meeting in August 1991, the MBSA directors recommended an operating scenario for the Corps' use in drafting the 1991-1992 AOP. They did not reach consensus on the plan; some of the upstream states held it did not go far enough to help recover system storage. The directors agreed, however, that the new process improved the way the AOP was developed.

In addition to expanded state participation, the Corps extended public involvement by holding four meetings in the fall of 1991, instead of the usual one public meeting. The meetings were headed by the Assistant Secretary of the Army for Civil Works, accompanied by her executive and a senior staff member of the Corps' Washington, D.C., headquarters water-management office. After review and discussion, the various operating schedules were submitted to the MRD Division Engineer for adoption. The plan then became the framework within which the RCC would schedule detailed daily operations throughout the following year.

Full public participation is needed in order to make the RCC process work well. All parties must strive to achieve "good" public policy characterized by an integrative process that transcends self-interest. As the recent history of Missouri River main-stem operations clearly shows, there are limits on how many interests can be satisfied with the substantive results of any one decision. Since system operations began, Corps

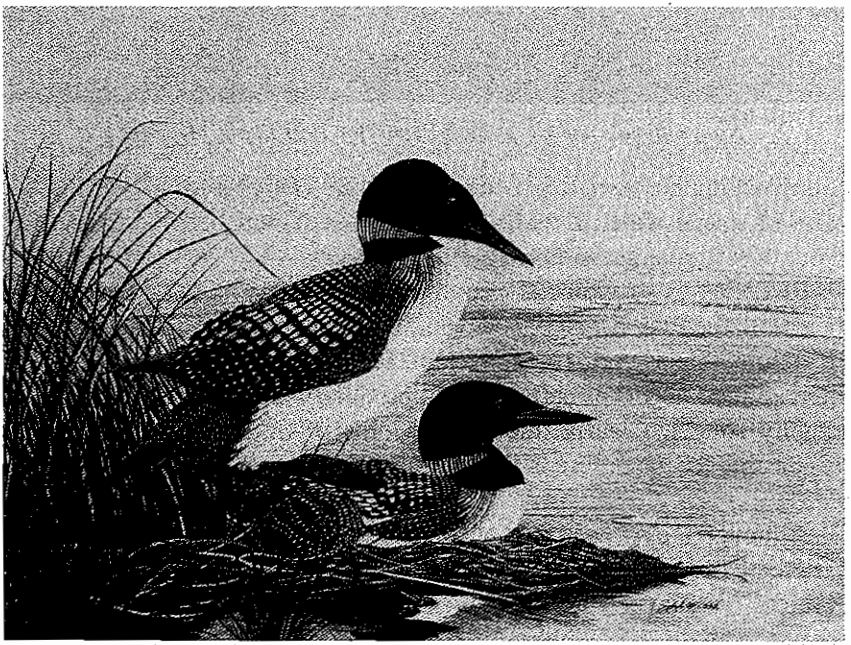
Army Officials and Corps Staff Depart for 1991 Public Meetings.

policymaking has been exposed to full public view. However, during the years of scarce water, a wider array of interests has become concerned about operational decisions.

Resulting frustration and resentment were based more on disappointment with the Pick-Sloan plan developments than with the conduct of the operations. Real-world outcomes of Pick-Sloan favored lower basin interests, and no Corps actions could produce what upper basin interests actually sought. Clearly, the Army Corps of Engineers is in no way responsible for the failure of the Bureau of Reclamation's basin irrigation plan.

Although the Army's Pick plan has been implemented successfully, it has created for the Corps what Lawrence Lynn called Murphy's Law of Politics: "Whatever you did, you should have done something else." In private, virtually every interest in the basin acknowledges that the RCC is performing efficiently and effectively. But when the original policy idea does not equate with the real-world outcome, operations decisions are subject to criticism by special interests.

Drought conditions in the 1980s deepened the resentment upper basin interests had against the lower basin beneficiaries and the Corps of Engineers. While processes for operations decisionmaking were being improved, upper basin resentment intensified because the "losers" thought their interests were being subverted to those of the lower basin "winners." Unable to achieve a basinwide consensus for their demands that the Corps make operations changes, and recognizing that they could not solve their problems through congressional legislation, upper basin states resorted to the courts.



Loons by Sallie Zydek.